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A RATIONAL DIABETIC FLOUR.

BY

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MEMBER OF THE NEW YORK COUNTY MEDICAL SOCIETY, THE MANHATTAN CLINICAL SOCIETY, THE MEDICO-LEGAL SOCIETY, ETC.

FROM

THE MEDICAL NEWS,

June 8, 1895.

[Reprinted from THE MEDICAL NEWS, June 8, 1895.]

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"GIVE us our daily bread"—this utterance of the faithful shows that bread is the recognized, most essential, and most important foodstuff to civilized man. In health and disease it forms his foremost nutriment. Thus by nature, habit, and custom humanity asks for bread and thrives on it, and when this article of food has been withheld or withdrawn from a person by famine, by high taxes, or by an over-zealous physician, that person might get along with other nourishment for a time, but will perish at the end from lack of proper food. The bodily constitution of civilized man demands some kind of breadstuff of which, it is true, it might be deprived temporarily and partially, but never for a long period or completely.

This fact has been recognized by some modern physiologists and observers who do not object to bread in small quantities as a part of the diet in diabetes mellitus. The complete and sudden deprivation of the system of breadstuffs it has heretofore been accustomed to, undoubtedly produces

[1] Read before the Manhattan Clinical Society, April 16, 1895.

more harm in a diabetic patient than a moderate use of that article of nutriment. (To stop wholly the saccharine supply is also not what is wanted, for were we to do so we would finally arrest every function of animal life.) Neither on its duration nor upon the percentage of sugar depends the severity of diabetes mellitus, but upon the general power of resistance of the body and the vitality of the non-affected organs; and the power of resistance and vitality must be sustained, even if an additional one-tenth of 1 per cent. of diabetic sugar may be demonstrated in the urine.

With the view of supplying properly adapted and suitable breadstuffs for diabetes the so-called "Diabetic Flours" have sprung into existence; and it is claimed that they are free, or nearly free, from carbohydrates. All these flours contain, however, large quantities of starch—from 30 per cent. to 70 per cent., as Purdy puts it. The widely advertised gluten flour of one health-food company, for instance, for which it is claimed that it is entirely free from starch, contains 66.18 per cent. of that article. It seems beyond our means at the present day to extract to a sufficient degree the carbohydrates of the marketable grains; in fact, if a complete extraction of the starchy principles of our grains could be accomplished, there would be very little left to make a satisfactory article of food. Bouchardat's gluten flour is obtained by washing wheat flour. It is evident that only small quantities of starch can be extracted by this process. A method of extracting the starch from bread was recommended by Liebig. Thin slices of bread were treated with an

extract of malt to convert the starch into sugar, which could be dissolved out by maceration and washing. The bran-bread of Prout, which contains a great percentage of cellulose, has not proved to be a desirable food for diabetics on account of its indigestibility and of its irritative action on the mucous membranes of the intestinal canal. The Soya bread and the aleuronaut bread of Ebstein have also been used in the dietetic treatment of diabetes without having achieved universal recognition and employment. The proportionally best substitute for wheat or rye to-day yet is the almond. Almond-bread was first introduced by Pavy. The almonds having been ground into small pieces undergo a process of maceration with acidulated water for the extraction of their sugar. If some butter and eggs be added to this almond-meal, a good-tasting bread can be baked, which, if not properly prepared, is very hard and oily, and not fit for digestion. Almonds, however, are very expensive, and this is one of the reasons that bread made from them is not more universally employed by diabetics.

A long time since I recognized the fact that *a completely decarbohydrated meal at a price convenient to every one cannot be obtained from any of the cereals;* that such a completely decarbohydrated meal is *not essential*, but is even a drawback in a rational diet of the diabetic; and that a meal like that of the almonds, partially unoiled and with a small percentage of carbohydrates, at a mere nominal cost, is the desideratum. After a series of experiments I came to the conclusion that such a meal can be obtained from the peanut.

The peanut[1] (*Arachis hypogæ*), also known as ground-pea, ground-nut, earth-nut, goober, and pindar, is an annual, growing from one to two feet high; it has the peculiar habit of wintering its fruit underground. It is not a nut at all in the true sense of the term, and should be with more propriety called ground-pea. After the fall of its flower the peduncle elongates and bends downward, pushing several inches into the ground, where the ovary at its extremity begins to enlarge and develops into a pale-yellowish, wrinkled, slightly curved pod, often contracted in the middle, and containing from one to three seeds. When fully grown the pods are from one to two inches long and of a yellowish color.

More or less abundantly scattered over the roots of the peanut plant are warts of about the size of a pin-head. These so-called tubercles are of great importance to the life of the plant. Within them, while in a fresh or growing state, immense numbers of minute organisms can be detected. These organisms live partly on the substance supplied from the roots, and at the same time they take from the air and elaborate for the use of the plant considerable quantities of nitrogen. In this manner a quantity of nitrogen is often acquired by the plant far in excess of the amount of that element contained in the neighboring soil. The peanut, though it has been cultivated for centuries in Eastern countries—in China, Japan, the East Indies, and Africa—seems to

[1] The following data and points of information are obtained from Farmers' Bulletin, No. 25, published by the U. S. Dept. of Agriculture, 1895.

be a native of Brazil. Thus America, which gave to the world cotton, Indian corn, the potato, and tobacco, is also the home of an additional plant of commercial importance. The merits of the peanut, however, had been recognized much earlier in other parts of the globe than in its native country, and virtually only since 1866 has the crop become of importance in some parts of this country. Virginia, North Carolina, and Tennessee produce most of the peanut crop of the United States, which, on account of a wrong method of culture, is not so plentiful now-a-days as it has been in years past.

The most interesting point for us to consider is the chemic composition of the peanut. I abstain from giving the food-constituents of all the different parts of the peanut plant, the kernels being the only portion of the plant concerning us. We find in the Alabama peanut-kernel 10.88 per cent. of water, and in the water-free substance of the kernel 4.26 per cent. of ash, 35.37 per cent. of protein, 2.66 per cent. of fiber, 19.33 per cent. extract-free of nitrogen, 55.37 per cent. of fat, and 5.50 per cent. of nitrogen. The average of all available analyses of peanut-plants of different crops and different sections of the earth shows 29 per cent. of protein, 49 per cent. of fat, and 14 per cent. of carbohydrates in the dry material.

Peanut-meal (as known in commerce) is the remaining part (the residue) of the peanut after the oil has been extracted. The oil is extracted on a large scale in European countries and utilized as a substitute for olive-oil, for lubricating purposes, and in the manufacture of soap. The meal contains, as

the averages of 2000 analyses show, about 52 per cent. of protein, 8 per cent. of fat, and 27 per cent. of carbohydrates, and is therefore a most concentrated and valuable animal food. The peanut-meal, or peanut-cake as it is commonly called, is of a quite agreeable taste and not very hard to digest. Following this is given a comparison made by Professor König, based on the price in Germany of the following twelve principal foods reduced to "units of nutrition:"

COMPARISON OF THE NUTRITIVE VALUE AND COST OF TWELVE PRINCIPAL FOODS.

	Nutritive units per pound.	Cost per 1000 units in cents.
Skimmed milk	98.20	10.4
Skimmed-milk cheese	870.00	11.0
Full milk	155.50	11.5
Bacon	1257.70	15.5
Butter	1186.30	20.4
Veal	525.90	22.2
Beef	530.90	26.0
Peas	778.60	4.2
Potatoes	138.20	5.1
Rye-flour	603.60	6.0
Rice	534.60	10.0
Peanut-meal	1425.00	3.0

This shows that peanut-meal is the most nutritious and the cheapest of this list of foodstuffs.

Satisfied that the peanut is one of the most perfect, and at the same time one of the cheapest foodstuffs known to us, a foodstuff abundant in nitrogenous and fatty matter, but very deficient in carbohydrates, I began to utilize it with diabetic patients, and my method of preparing what I call the "diabetic peanut-flour" is a very simple and

empiric one, and only destined to be employed domestically. I do not intend to give in the following a process of manufacture on a large scale; but no doubt, if this peanut-flour should prove to be a permanent success in the dietetic treatment of diabetes, the proper means to obtain the flour in large quantities can be easily devised.

The peanut-kernels, including their inner coating, which is also nutritious and not very abundant in carbohydrates, are put in a tin kettle, into which small holes have been previously made. This is kept uncovered and placed on or into a pan filled with water, and this has to be kept boiling for about half an hour to allow partial extraction of the superfluous oil. After the kernels have been dried they are pounded into fine particles with the aid of a rolling-pin. The pounded or bruised kernels are then placed in boiling water acidulated to some degree with tartaric acid or vinegar, preferably with the latter. The boiling in the acidulated water has to be continued for some time for different reasons:

1. For the extraction of saccharine elements, occurring to some amount in nuts of American growth. (Peanut-flour naturally contains proportionally small quantities of saccharine principles, which have to remain to some extent in the flour for reasons given.)

2. To overcome the smell and taste characteristic of the peanut.

3. To prevent emulsification of the remaining oil, which, to some degree, is essential to a rational diabetic food, as fats must supply the deficiency of the carbohydrate elements. (An emulsifying process will otherwise take place immediately on the addition of water, as great quantities of albuminous matters are present.)

It is true that a partial emulsification of the oil

might relieve the pancreatic juice of some work, and this might be especially beneficial in such grave cases of diabetes mellitus in which the pancreas seems to be involved. I leave it to future investigation to determine whether the oil in peanut-flour shall be introduced in its natural state into the alimentary tract or in the form of a partial or complete emulsion.

Having undergone a thorough boiling with acidulated water, the ground kernels are subjected to dry heat, to effect complete evaporation of that fluid; but great care must be exercised that they do not become browned or roasted. An additional treatment with the rolling-pin will produce nearly as fine a flour as the common wheat-flour of commerce.[1]

With apparatus such as the household furnishes a flour such as the mills are capable of producing on a great scale cannot be expected to be produced. This is especially true with the hydrocarbonization (unoiling) of the flour. From 30 to 40 per cent. of the oil I deem necessary for a complete and rational diabetic food. More hydrocarbons are not required and would interfere with digestion. It is not possible to control the unoiling by the described domestic process and to determine with any degree of certainty the percentage of oil extracted; if the flour is manufactured by mills, however, this could be readily controlled and ascertained. The most simple process of extracting the oil, when manufacturing the flour on a large scale, is by pressure, either by the employment of the cold or the warm process; the pressure can be so regulated as to extract just the amount of oil that is not wanted.

[1] Samples of the peanut-flour were passed among the audience and different tests were applied to it, to the satisfaction of those present.

I have made use of the flour in different ways, the most simple of which is in the form of a porridge, some milk being added to it. Bread and biscuits can also be baked from it, but the nicest and most easily digestible form in which to utilize it is, I think, the German pancake. Every housekeeper understands how to make the latter, and a tasty and always fresh piece of pastry can therefore be produced on short notice.

I have used this flour with four diabetic and a number of other patients of mine. In the non-diabetic cases, mostly tuberculous in character, I obtained satisfactory results, inasmuch as digestion was not to any extent taxed, and in some cases the weight of the patient did not decrease, while in one instance there was actual gain in weight noticed.

The first diabetic patient to whom I recommended the flour was also the first person whom I know to have made use of it. Right at the outset it turned out to be a complete failure, as the digestion became very much impaired, thereby aggravating the general condition of the patient, an old man. A more careful and rational preparation of the flour, however, and the employment of smaller quantities when starting with it, increased its digestibility, and to-day this patient enjoys, as far as circumstances permit, a comfortable state of health. The other three patients also thrive well on this flour, the German pancake being the usual form in which they employ it. In conjunction with eatables made of this flour I allowed those patients only such foodstuffs as are generally recognized as permissible in diabetes mellitus. I have done this, not

because I am a believer in the complete exclusion of carbohydrates in diabetes, which I am not (fats and even nitrogenous substances are capable of producing glycogen), but to investigate the intrinsic value of peanut-flour as a food and its ability to reduce the glycogenic sugar of the urine. In the last point, however, my researches only began at a late date and practical results I cannot offer to-day.

After my bad experience in the very first trial I accustomed the patients gradually to the flour and started in every instance with 15 grams a day, gradually increasing the quantity to 25 grams daily in the second week, 35 grams in the third week, and so forth. I did not experience any more gastric disturbances or diarrhea by the employment of the peanut-flour than is the case when using an absolutely animal diet.

If we accept the theories advanced by modern investigators in the dietetic treatment of diabetes mellitus, that a suitable and wholesome diabetic food must be easily digestible, abundant in fatty and nitrogenous, and deficient in saccharine and starchy substances, we have to consider peanut-flour a rational and logical foodstuff.

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